Decimal Index
551.524.31

METEOROLOGICAL OFFICE

CLIMATOLOGICAL SERVICES (M.O.3)

CLIMATOLOGICAL MEMORANDA, No.28

FREQUENCY DISTRIBUTION OF THE DAILY RANGE OF TEMPERATURE AT KEW OBSERVATORY AND LONDON AIRPORT

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INTRODUCTION

This memorandum presents the results of an analysis of the daily ranges of temperature recorded at Kew Observatory during the years 1901-1950. Data are also given for London Airport for the period 1949-1958 as these were recently extracted from punched cards to answer an inquiry.

KEW OBSERVATORY DATA

The daily ranges of temperature at Kew were obtained from the values of daily maximum and minimum temperature (0000h-2400h) in degrees Absolute as published in the Observatories' Year Book. Monthly frequency tables of daily range were then compiled for ranges at intervals of one degree Celsius, the exact ranges covered being $\leq$ 0.5°C, 0.5-1.4°C, 1.5-2.4°C. etc. The data were considered in two periods, 1901-1950 and 1921-1950, the latter being the current standard period for temperature averages.

Tables I and II give the monthly percentage frequencies of daily temperature ranges at Kew for the periods 1901-1950 and 1921-1950 respectively. The mean ranges for each month are also given in these tables. Figure 1 presents the 1921-1950 frequencies in the form of histograms.

LONDON AIRPORT DATA

The daily ranges at London Airport were obtained from the minimum temperature read at 0900 G.M.T. and the maximum temperature read at 2100 G.M.T. recorded in whole degrees Fahrenheit. Frequency tables of daily range were compiled for ranges of two degrees Fahrenheit up to 34°F. For daily ranges of 34°F. or more the frequencies were compiled for ranges of one degree Fahrenheit. The data were for the period 1949-1958 inclusive.

Table III gives the monthly percentage frequencies of daily temperature range at London Airport for the period 1949-1958 together with the annual values. The mean ranges are given both in Fahrenheit and Celsius. Figure 2 shows the frequencies in the form of histograms.

The data for London Airport which were on punched cards were also sorted for daily mean temperature, this temperature being taken as half the sum of the 0900 G.M.T. minimum temperature and the 2100 G.M.T. maximum temperature.

Table IV and Table V give the combined distribution of the daily range of temperature and daily mean temperature at London Airport for the period 1949-1958. The ranges for the daily range are as in Table III and the ranges of daily mean temperature are 20-24°F, 25-29°F, 30-34°F. etc., up to 75-79°F. Table IV is for the twelve months and Table V is for the year as a whole.

Comment

The results for Kew are very little different for the two periods 1921-1950 and 1901-1950. The mean ranges are the same for the year and for January, February and June. The mean ranges differ for the two periods by only 0.1°C. for April, May, July, August, September, October and December and by 0.2°C. for March and November.

Comparing the mean ranges for Kew with those for London Airport in °C Celsius which are for the period 1949-1958 we see that those for London Airport are appreciably higher forevery month. It should however be remembered that the results being compared are for different periods: still it would seem that there is a significant difference between the results for Kew and London Airport. One reason for this is thought to be that the Kew values were obtained from a screen on the North Wall, whereas the London Airport values were obtained from a better exposed Stevenson screen. The minimum temperatures are likely to be considerably higher in the North Wall screen (see Quarterly Journal, R.Met.S. Vol.69, April 1943, Page 154) than in a well exposed Stevenson screen. Thus the daily range can be expected to be smaller. Another reason may be the more exposed situation of London Airport.

Table I. Kew Diurnal Temperature Range (°C.)
Frequency Percentages and Means
1901-1950

Range \ Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
0.0 - 0.4													0.0
0.5 - 1.4	2.4	1.7	0.2	0.1						0.2	1.5	2.9	0.7
1.5 - 2.4	11.1	7.4	3.0	1.1	0.3	0.4	0.5	0.6	0.7	2.4	6.3	11.5	3.8
2.5 - 3.4	15.7	12.0	5.9	2.7	1.9	1.7	1.3	1.0	2.2	4.5	11.7	17.7	6.5
3.5 - 4.4	17.7	19.5	9.7	4.7	3.0	2.9	3.7	3.2	4.9	9.7	16.5	18.1	9.4
4.5 - 5.4	18.4	14.9	13.7	8.9	4.9	4.9	5.7	6.2	9.7	14.1	16.1	18.9	11.3
5.5 - 6.4	13.7	13.5	16.0	14.7	8.1	9.5	11.3	11.3	12.4	14.5	14.6	11.2	12.5
6.5 - 7.4	8.1	10.6	13.9	15.7	13.2	12.7	14.2	15.2	15.5	14.2	12.6	8.1	12.8
7.5 - 8.4	6.5	8.5	10.5	13.1	13.7	14.0	14.3	14.3	15.4	13.0	7.5	5.4	11.4
8.5 - 9.4	3.7	4.6	7.4	10.5	10.8	12.3	10.5	12.8	11.1	8.5	5.9	3.0	8.4
9.5 - 10.4	1.4	3.0	6.5	8.1	10.6	11.6	10.1	9.6	8.8	6.7	4.1	2.1	6.8
10.5 - 11.4	0.6	2.1	4.5	6.3	9.5	8.0	8.5	7.4	5.9	5.2	2.2	0.7	5.1
11.5 - 12.4	0.2	0.9	2.5	4.7	8.8	6.9	6.8	5.8	4.3	2.9	0.5	0.4	3.7
12.5 - 13.4	0.3	0.7	2.1	4.3	5.0	5.7	5.1	5.4	3.3	2.0	0.3	0.1	2.9
13.5 - 14.4	0.1	0.1	1.4	2.7	4.4	3.8	3.7	3.2	2.3	1.0	0.1		1.9
14.5 - 15.4	0.1	0.1	1.0	1.3	3.4	2.9	1.8	1.8	1.4	0.8		0.1	1.2
15.5 - 16.4	0.1	0.2	0.7	0.7	1.5	1.7	1.5	1.2	0.7	0.3			0.7
16.5 - 17.4			0.5	0.7	0.6	0.7	0.9	0.5	0.7			0.1	0.4
17.5 - 18.4			0.3	0.1	0.3	0.3	0.1	0.2	0.5	0.1			0.2
18.5 - 19.4			0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1		0.1	0.1
19.5 - 20.4			0.1				0.1		0.1				0.1
Mean Range	4.9	5.5	7.1	8.1	9.3	9.1	8.9	8.7	8.1	7.1	5.6	4.8	7.3

Table II. Kew Diurnal Temperature Range (°C.)
Frequency Percentages and Means
1921-1950

Range \ Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
0.0 - 0.4													0.0
0.5 - 1.4	2.4	2.1	0.2							0.1	1.8	3.2	0.8
1.5 - 2.4	9.7	7.5	2.6	1.6	0.1	0.3	0.4	0.5	0.9	2.1	6.6	11.4	3.6
2.5 - 3.4	16.4	11.9	5.9	3.3	2.5	1.6	1.5	1.1	2.1	5.1	12.3	18.9	6.8
3.5 - 4.4	17.3	19.7	10.2	5.0	2.7	2.3	4.0	3.3	5.7	9.0	17.0	17.0	9.4
4.5 - 5.4	18.7	14.1	12.8	9.8	4.9	5.5	5.5	6.5	10.6	16.4	15.8	19.3	11.9
5.5 - 6.4	14.1	13.8	14.7	13.5	8.1	10.4	11.7	13.1	12.8	14.4	14.0	11.2	12.6
6.5 - 7.4	8.1	10.6	11.7	15.6	13.8	13.2	14.7	14.7	15.7	13.8	11.3	8.2	12.7
7.5 - 8.4	6.1	7.9	10.0	13.2	13.6	14.5	14.0	12.2	15.8	12.6	6.5	5.1	10.9
8.5 - 9.4	4.5	4.7	8.3	10.1	11.5	12.1	10.3	13.4	10.6	8.7	5.8	3.1	8.6
9.5 - 10.4	1.8	3.5	7.1	7.3	10.0	11.3	10.6	9.5	8.5	6.7	3.8	1.9	6.8
10.5 - 11.4	0.5	2.5	5.5	6.8	9.9	6.7	7.7	7.2	6.6	4.9	1.1	0.8	5.0
11.5 - 12.4	0.1	0.3	2.4	4.3	8.1	6.8	6.3	6.3	4.6	2.5	0.4	0.2	3.5
12.5 - 13.4	0.1	0.8	2.5	4.9	4.9	5.9	5.4	5.1	2.7	2.0	0.4		2.9
13.5 - 14.4	0.1		1.5	2.5	5.3	3.8	3.6	3.7	1.8	0.3	0.1		1.9
14.5 - 15.4		0.3	1.8	1.0	2.6	3.2	1.9	2.1	1.0	0.6			1.6
15.5 - 16.4	0.1		1.0	0.6	1.3	1.4	1.3	1.0	0.6	0.4			0.6
16.5 - 17.4			0.6	0.6	0.8	0.9	1.0	0.4	0.2	-			0.4
17.5 - 18.4			0.2		0.2	0.3	0.1	0.2	0.4	0.1			0.1
18.5 - 19.4			0.5				0.1		0.1	0.1			0.1
19.5 - 20.4													0.0
Mean Range	4.9	5.5	7.3	8.0	9.2	9.1	8.8	8.8	8.0	7.0	5.4	4.7	7.3

Table III. London Airport Diurnal Temperature Range

Frequency Percentage and Means

1949-1958

Range °F. \ Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
2 - 3	4.5	1.1	0.6			0.3				1.3	2.7	3.9	1.2
4 - 5	10.3	8.9	3.9	1.3		0.7	0.3	1.3	0.7	2.9	9.0	11.9	4.2
6 - 7	14.2	12.4	5.8	1.0	2.9	2.0	3.2	1.9	2.3	9.0	15.0	19.7	7.4
8 - 9	18.1	13.5	14.5	4.7	4.8	4.0	5.5	6.8	8.7	9.0	16.3	14.5	10.0
10 - 11	20.3	19.5	15.2	11.7	8.4	8.7	6.1	10.6	11.7	10.6	13.7	15.5	12.6
12 - 13	11.9	13.5	13.2	9.7	13.5	11.3	15.5	12.9	20.3	18.7	15.0	12.6	14.0
14 - 15	10.3	11.0	14.2	16.3	13.5	9.3	14.8	14.8	13.3	12.9	12.3	11.9	12.9
16 - 17	3.2	8.9	7.1	11.3	11.9	14.0	11.3	12.3	10.7	11.0	8.3	3.9	9.5
18 - 19	4.5	4.6	10.6	11.3	10.6	12.3	12.3	10.6	12.3	7.7	3.7	3.5	8.7
20 - 21	1.9	3.2	4.8	8.7	6.1	9.7	9.4	9.4	8.7	6.5	2.0	1.6	6.0
22 - 23	0.6	1.4	3.9	7.0	8.1	8.0	6.1	8.7	5.7	4.8	0.3	0.6	4.6
24 - 25		1.1	1.6	9.0	7.7	6.7	7.1	4.5	2.0	2.9	1.3	0.3	3.7
26 - 27		0.7	1.6	3.3	4.5	5.3	3.9	2.9	1.7	1.9	0.3		2.2
28 - 29		0.4	0.6	2.7	4.5	3.3	2.3	1.9	1.0	0.3			1.4
30 - 31			0.6	0.7	2.3	3.0	0.3	1.0	1.0	0.3			0.8
32 - 33			1.3	0.7	0.6	1.3	1.0	0.3					0.4
34				0.3	0.3								0.1
35							0.6						0.1
36							0.3						0.0
37				0.3									0.0
38													
39													
40													
41													
42													
43			0.3										0.0
Mean °F. Range	10.5	11.5	13.9	17.1	17.5	17.9	17.0	16.3	15.2	13.9	10.9	9.9	14.3
Mean Range °C.	5.8	6.4	7.7	9.5	9.7	9.9	9.4	9.1	8.4	7.7	6.1	5.5	7.9

TABLE IV

LONDON AIRPORT 1949-1958

Combined Distribution of diurnal range of temperature and daily mean temperature (°F.) based on daily minimum and maximum temperatures read at 0900 G.M.T. and 2100 G.M.T.

JANUARY

Diurnal Range \ Daily Mean Temp.	25°- 29°	30°- 34°	35°- 39°	40°- 44°	45°- 49°	50°- 54°
2° or 3°		4	6	1	1	2
4° or 5°	1	11	6	5	6	3
6° or 7°	2	6	12	11	12	1
8° or 9°	2	11	18	13	11	1
10° or 11°	4	8	18	25	7	1
12° or 13°	1	6	9	14	5	2
14° or 15°	5	6	10	10	1	
16° or 17°		1	5	2	2	
18° or 19°		3	4	6	1	
20° or 21°		1	3	2		
22° or 23°	1			1		

FEBRUARY

Diurnal Range \ Daily Mean Temp.	20°- 24°	25°- 29°	30°- 34°	35°- 39°	40°- 44°	45°- 49°	50°- 54°
2° or 3°			2			1	
4° or 5°		1	9	5	6	4	
6° or 7°	1	6	4	7	5	4	8
8° or 9°	1	2	5	13	9	6	2
10° or 11°	1	6	6	12	18	11	1
12° or 13°		1	3	12	14	6	2
14° or 15°		2	7	8	12	2	
16° or 17°			4	11	8	2	
18° or 19°				3	7	2	1
20° or 21°		1	3	3	2		
22° or 23°		1		1	2		
24° or 25°			1	1	1		
26° or 27°				1		1	
28° or 29°					1		

MARCH

Diurnal Range \ Daily Mean Temp.	25°- 29°	30°- 34°	35°- 39°	40°- 44°	45°- 49°	50°- 54°	55°- 59°
2° or 3°					2		
4° or 5°		3	5	1	2	1	
6° or 7°		2	4	4	2	6	
8° or 9°		3	8	11	11	12	
10° or 11°	1	2	7	12	15	10	
12° or 13°		3	10	8	14	6	
14° or 15°		1	10	11	14	7	1
16° or 17°		3	6	6	6	1	
18° or 19°		1	10	9	9	3	1
20° or 21°		2	5	1	5	2	
22° or 23°			3	2	5	2	
24° or 25°			1		3	1	
26° or 27°			1	1	2	1	
28° or 29°					2		
30° or 31°				2			
32° or 33°				2	1	1	
43°					1		

APRIL

Diurnal Range \ Daily Mean Temp.	35°- 39°	40°- 44°	45°- 49°	50°- 54°	55°- 59°	60°- 64°	65°- 69°
4° or 5°		1	2	1			
6° or 7°		2		1			
8° or 9°		2	7	4	1		
10° or 11°	1	7	17	9	1		
12° or 13°	2	6	12	9			
14° or 15°	4	13	14	13	5		
16° or 17°	1	8	19	3	3		
18° or 19°	1	14	9	7	3		
20° or 21°	1	10	6	5	3	1	
22° or 23°		4	13	2	1	1	
24° or 25°		3	8	12	2	2	
26° or 27°		1	4	2	2	1	
28° or 29°		1	1	6			
30° or 31°			1		1		
32° or 33°					1	1	
34°							1
37°					1		

MAY

Diurnal Range \ Daily Mean Temp.	40°- 44°	45°- 49°	50°- 54°	55°- 59°	60°- 64°	65°- 69°	70°- 74°
6° or 7°		3	4	2			
8° or 9°	1	6	4	4			
10° or 11°	2	2	11	9	2		
12° or 13°	2	6	15	15	3	1	
14° or 15°	1	5	13	16	6	1	
16° or 17°	1	3	18	14	1		
18° or 19°	3	2	20	8			
20° or 21°		4	5	9	1		
22° or 23°		3	10	6	3	3	
24° or 25°		4	6	5	8	1	
26° or 27°			6	5	2	1	
28° or 29°		1	6	5	1		1
30° or 31°		1	3		1	2	
32° or 33°				2			
34°					1		

JUNE

Diurnal Range \ Daily Mean Temp.	45°- 49°	50°- 54°	55°- 59°	60°- 64°	65°- 69°	70°- 74°	75°- 79°
2° or 3°			1				
4° or 5°		2					
6° or 7°		3	3				
8° or 9°	1	3	4	4			
10° or 11°		9	9	8			
12° or 13°	1	1	12	15	5		
14° or 15°		3	11	12	1	1	
16° or 17°	1	5	13	16	5	2	
18° or 19°		7	12	13	3	2	
20° or 21°		7	8	10	4		
22° or 23°		5	10	5	2	1	1
24° or 25°			6	10	3	1	
26° or 27°			4	8	1	3	
28° or 29°				4	4	2	
30° or 31°			1	5		2	1
32° or 33°				1	1	2	

TABLE IV
(Continued)

JULY

Duirnal Range \ Daily Mean Temp.	50°- 54°	55°- 59°	60°- 64°	65°- 69°	70°- 74°	75°- 79°
4° or 5°			1			
6° or 7°		4	5	1		
8° or 9°		8	5	4		
10° or 11°		4	13	2		
12° or 13°		14	25	9		
14° or 15°	2	7	22	13	2	
16° or 17°	1	4	18	9	3	
18° or 19°		2	20	13	3	
20° or 21°		7	10	6	6	
22° or 23°		3	6	3	6	1
24° or 25°		1	8	10	3	
26° or 27°		1	2	6	2	1
28° or 29°		1	2	2	1	1
30° or 31°				1		
32° or 33°				3		
35°				1	1	
36°				1		

AUGUST

Duirnal Range \ Daily Mean Temp.	50°- 54°	55°- 59°	60°- 64°	65°- 69°	70°- 74°	75°- 79°
4° or 5°	1	2	1			
6° or 7°		2	3	1		
8° or 9°	1	3	15	2		
10° or 11°		10	18	5		
12° or 13°	2	8	18	11	1	
14° or 15°		12	20	13	1	
16° or 17°		15	14	9		
18° or 19°		13	7	11	2	
20° or 21°	2	8	9	9	1	
22° or 23°		7	11	8	1	
24° or 25°		2	2	7	3	
26° or 27°		1	5	1	1	1
28° or 29°		1	1	3		1
30° or 31°			2	1		
32° or 33°				1		

SEPTEMBER

Duirnal Range \ Daily Mean Temp.	45°- 49°	50°- 54°	55°- 59°	60°- 64°	65°- 69°	70°- 74°	75°- 79°
4° or 5°			2				
6° or 7°			2	4	1		
8° or 9°	2	2	12	8	2		
10° or 11°		2	15	13	5		
12° or 13°		9	19	24	9		
14° or 15°	2	16	13	7	2		
16° or 17°		10	9	7	6		
18° or 19°	2	6	17	7	4	1	
20° or 21°	3	6	7	6	3		1
22° or 23°	2		8	4	3		
24° or 25°	2	2	1	1			
26° or 27°			2	3			
28° or 29°		2		1			
30° or 31°				1	1	1	

OCTOBER

Duirnal Range \ Daily Mean Temp.	35°- 39°	40°- 44°	45°- 49°	50°- 54°	55°- 59°	60°- 64°
2° or 3°			2	2		
4° or 5°			1	4	4	
6° or 7°			3	12	12	1
8° or 9°		1	4	11	9	3
10° or 11°		2	8	12	8	3
12° or 13°	2	2	13	26	13	2
14° or 15°	1	2	8	18	8	3
16° or 17°		6	9	8	6	5
18° or 19°		5	5	10	2	2
20° or 21°	4	1	9	3	2	1
22° or 23°	3	2	3	4	3	
24° or 25°		2	2	5		
26° or 27°		2	2		1	1
28° or 29°		1				
30° or 31°				1		

NOVEMBER

Diurnal Range \ Daily Mean Temp.	25°- 29°	30°- 34°	35°- 39°	40°- 44°	45°- 49°	50°- 54°	55°- 59°
2° or 3°			1	3	3	1	
4° or 5°			1	10	11	5	
6° or 7°			2	15	17	11	
8° or 9°		4	6	13	18	7	1
10° or 11°		3	3	13	10	12	
12° or 13°		3	6	12	15	9	
14° or 15°	1	2	4	18	10	2	
16° or 17°			8	11	5	1	
18° or 19°			2	6	3		
20° or 21°		1		3	2		
22° or 23°				1			
24° or 25°			1	3			
26° or 27°			1				

DECEMBER

Diurnal Range \ Daily Mean Temp.	25°- 29°	30°- 34°	35°- 39°	40°- 44°	45°- 49°	50°- 54°	55°- 59°
2° or 3°		2	4	1	2	3	
4° or 5°		3	5	11	13	5	
6° or 7°	3	8	18	7	18	7	
8° or 9°	3	5	8	14	13	2	
10° or 11°		6	11	15	11	4	1
12° or 13°		5	11	11	9	3	
14° or 15°	1	4	9	17	6		
16° or 17°	1	2	3	4	2		
18° or 19°		2	3	4	2		
20° or 21°		1		4			
22° or 23°			1	1			
24° or 25°			1				

TABLE V

LONDON AIRPORT 1949 - 1958.

Combined distribution of diurnal range of temperature and daily mean temperature (°F) based on daily minimum and maximum temperatures read at 0900 GMT and 2100 GMT

ANNUAL

Daily Mean Temp. / Diurnal Range	20° - 24°	25° - 29°	30° - 34°	35° - 39°	40° - 44°	45° - 49°	50° - 54°	55° - 59°	60° - 64°	65° - 69°	70° - 74°	75° - 79°
2° or 3°			8	11	5	11	8	1				
4° or 5°		2	26	22	34	39	22	8	2			
6° or 7°	1	11	20	43	44	59	53	25	13	3		
8° or 9°	1	7	28	53	64	79	49	42	35	8		
10° or 11°	1	11	25	51	92	79	71	57	57	12		
12° or 13°		2	20	52	69	81	84	81	87	35	1	
14° or 15°		9	20	46	84	62	74	73	70	30	4	
16° or 17°		1	10	34	46	49	47	64	61	29	5	
18° or 19°			6	23	54	35	54	58	49	31	8	
20° or 21°		1	8	17	25	31	30	44	38	22	7	1
22° or 23°		2		8	13	26	23	38	30	19	8	2
24° or 25°			1	4	9	19	26	17	31	21	7	
26° or 27°				3	4	9	9	16	22	9	6	2
28° or 29°					3	4	14	7	9	9	4	2
30° or 31°					2	2	4	2	9	5	3	1
32° o 33°							1	3	2	5	2	
34°									1	1		
35°										1	1	
36°										1		
37°								1				
43°						1						

Fig. 1 KEW (1921 - 1950)

Histograms for monthly frequency percentage of diurnal temperature range

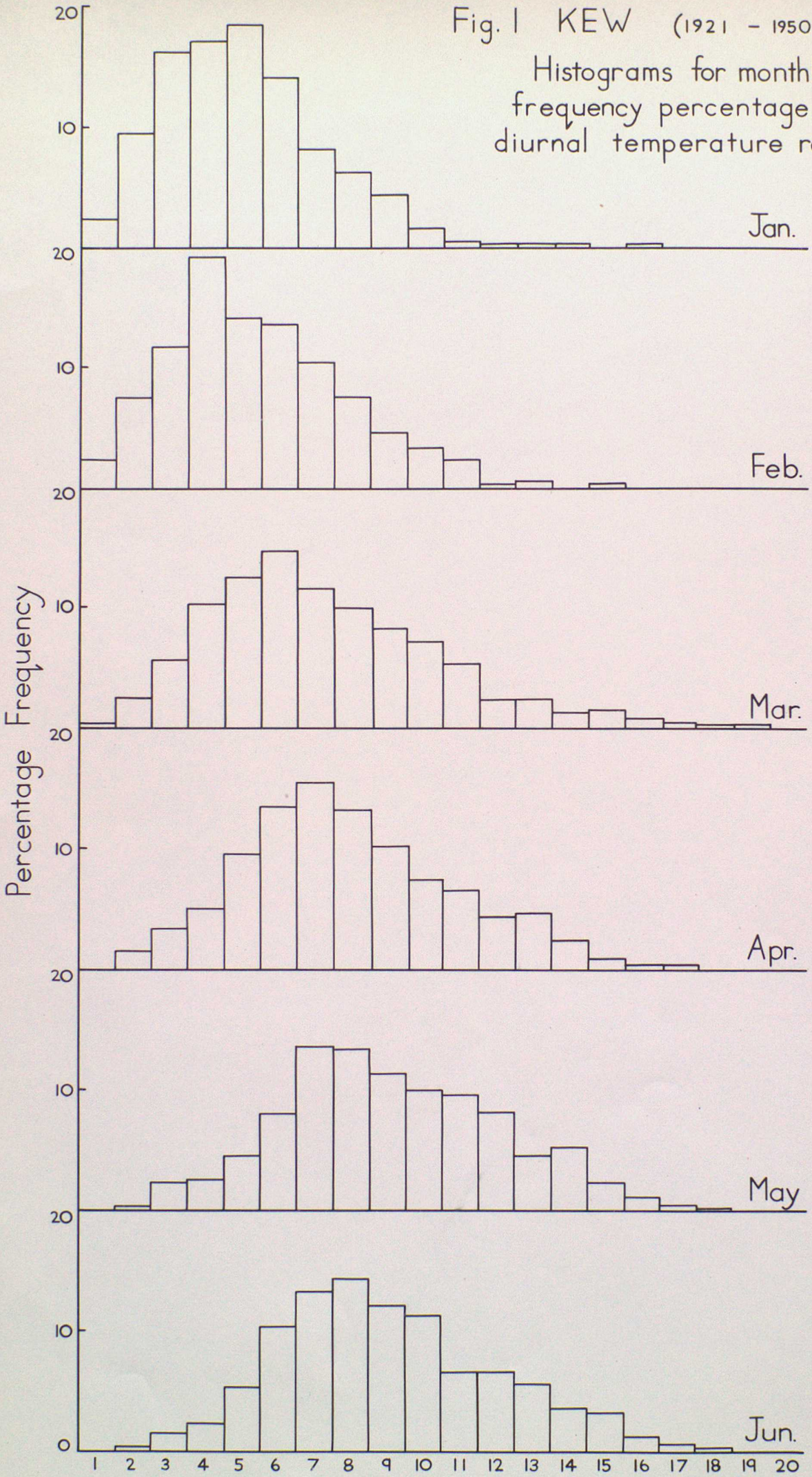

Fig.1 (cont.) KEW (1921 - 1950)

Histograms for monthly frequency percentage of diurnal temperature range

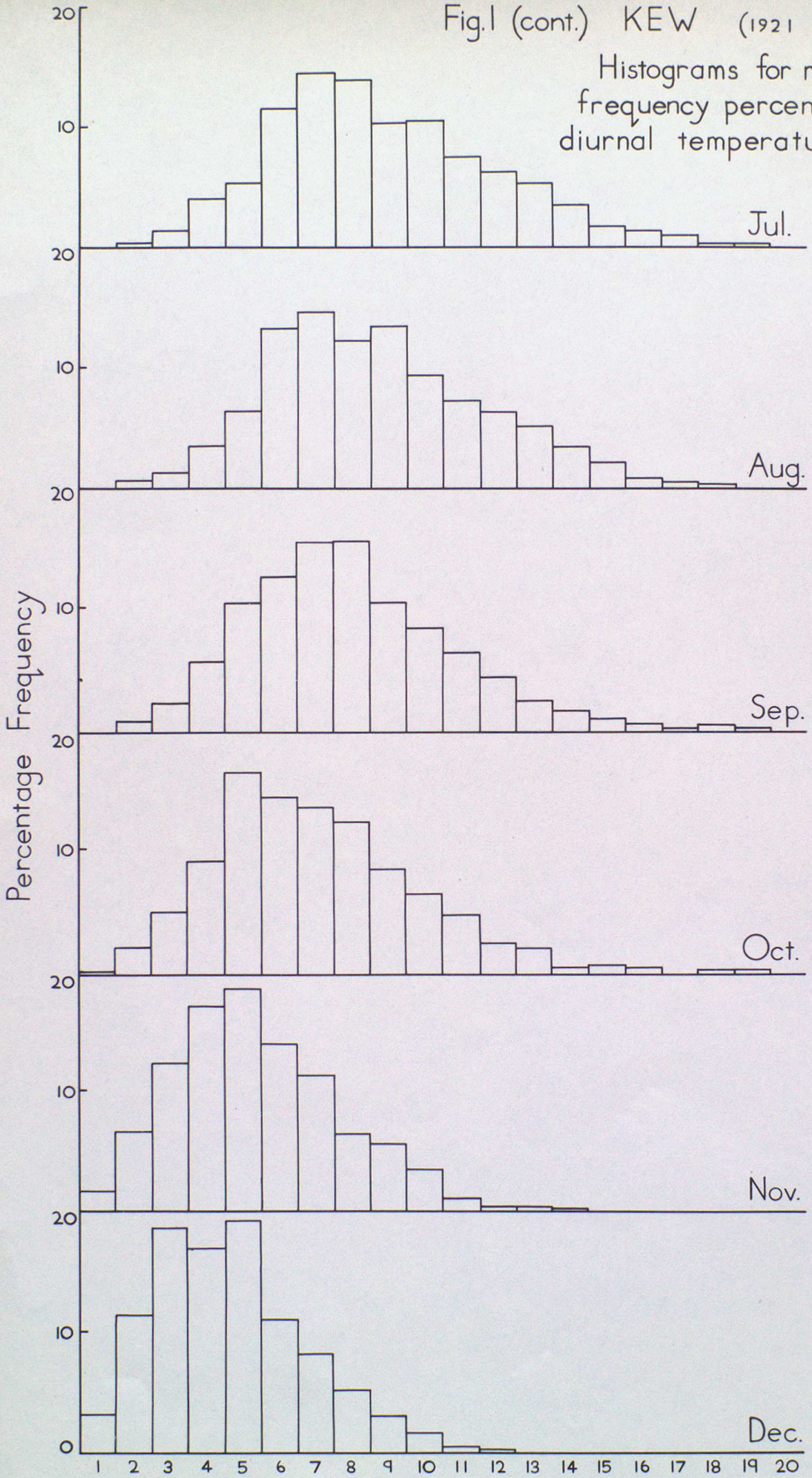

Fig. 2 LONDON AIRPORT (1949 - 1958)
Histograms for monthly frequency percentage of diurnal temperature range